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THE ROLE OF PERMANENT FIRST MOLAR RELATIONSHIP IN ASSESSING CLASS II MALOCCLUSIONS BASED ON THE ANALYSIS OF DIAGNOSTIC MODELS FROM THE PALATAL SIDE

ROLA RELACJI PIERWSZYCH ZĘBÓW TRZONOWYCH STAŁYCH W OCENIE WAD KLASY II NA PODSTAWIE ANALIZY MODELI DIAGNOSTYCZNYCH OD STRONY PODNIEBIENNEJ

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Abstract

Aim: The aim of the work is to determine the significance of posterior relationship between the first upper and lower molars from the palatal side in diagnosing Class II malocclusions.

Material and methods: One hundred and fifty diagnostic models and lateral cephalograms of patients from the Zbigniew Żak District Memorial Outpatient Clinic in Cracow were assessed.

Results: Out of 150 patients, skeletal Class II was diagnosed in 108 patients based on measuring the ANB angle (>4°), and in 115 patients based on the Wits appraisal (≥2 mm). In 68 patients (45.3%) with a bilateral complete posterior relationship of permanent first molars from the palatal side, skeletal Class II was confirmed on the basis of the ANB angle (>4°). In 3 patients (2%) skeletal Class II did not occur, despite a bilateral complete posterior relationship of permanent first molars from the palatal side. In 69 patients (46%) with a bilateral complete posterior relationship of permanent first molars from the palatal side, skeletal Class II was confirmed by means of the Wits appraisal. Only in 2 patients (1.3%), skeletal Class II did not occur despite a bilateral complete posterior relationship of permanent first molars from the palatal side.

Conclusions: The occurrence of a bilateral complete posterior relationship of permanent first molars from the palatal side constitutes a very reliable predictive parameter of skeletal Class II. Diagnosing a correct first molar relationship from the palatal side leads to a high probability that skeletal Class II does not occur.

Key words: class II malocclusions, diagnostics, models

Streszczenie

Cel: Celem pracy jest określenie znaczenia dotylnej relacji pierwszych zębów trzonowych górnych i dolnych od strony podniebiennej w diagnostyce wady klasy II.

Materiał i metody: Oceniono 150 modeli diagnostycznych oraz telerentgenogramów bocznych głowy pacjentów Wojewódzkiej Przychodni Stomatologicznej w Krakowie.

Wyniki: Z grupy150 pacjentów zdiagnozowano II klasę szkieletową u 108 pacjentów na podstawie pomiaru kąta ANB (powyżej 4°), a u 115 na podstawie pomiaru WITS (większy lub równy 2 mm). W 68 przypadkach (45,3%), u których wykryto obustronnie, pełną relację dotylną pierwszych, stałych zębów trzonowych od strony podniebiennej potwierdzono II klasę szkieletową na podstawie kąta ANB powyżej 4°, a jedynie w 3 przypadkach (2%) nie występowała II klasa szkieletowa, mimo występowania obustronnej pełnej relacji dotylnej pierwszych, stałych zębów trzonowych od strony podniebiennej. W 69 przypadkach (46%), u których wykryto obustronną, pełną relację dotylną pierwszych, stałych zębów trzonowych od strony podniebiennej potwierdzono II klasę szkieletową na podstawie pomiaru Wits. Jedynie w 2 przypadkach (1,3%) nie występowała II klasa szkieletowa, mimo występowania obustronnie pełnej relacji dotylnej pierwszych, stałych zębów trzonowych od strony podniebiennej.

Wnioski: Występowanie obustronnej pełnej relacji dotylnej pierwszych stałych zębów trzonowych od strony podniebiennej stanowi bardzo wiarygodny parametr predykcyjny II klasy szkieletowej. Stwierdzenie prawidłowej relacji pierwszych zębów trzonowych od strony podniebiennej daje wysokie prawdopodobieństwo braku występowania II klasy szkieletowej.

Słowa kluczowe: wady zgryzu klasy II, diagnostyka, modele

INTRODUCTION

Class II malocclusions are the most frequent disorders [1] of the masticatory system [2], constituting around 45% of all malocclusions. A study carried out in Wrocław kindergartens showed that the most frequent malocclusion among children between 3 and 5 years of age was distocclusion (20.41% of the children). The highest percentage of distal occlusions was diagnosed in 3-year-olds (29.23%) [3]. Among 6-year-olds the occurrence of distocclusions was 13.7% in Wrocław, 23.7% in Poznań, 27% in Lwówek Śląski, 46% in the Masovia voivodeship and 13.7% in Wrocław [4-7]. A study conducted in 2002 in Bielsko-Biała among 8-year-olds showed the occurrence of distocclusions in 19.4% of the children examined, which constituted 32.6% of all the diagnosed malocclusions [8]. According to a 2006 study, distocclusion was diagnosed in 16.4% of 8-year-olds from the Lower Silesian voivodeship, which constitutes 43.8% of all malocclusions [9]. According to the research conducted by the Department of Orthodontics of the Medical University of Gdańsk, the most frequently occurring disorders in a group of 8- and 9-year-olds were distocclusions, which constituted 51.7% of all the diagnosed malocclusions [10].

Distocclusion is defined by means of various classifications taking into account dental and/or skeletal relationships. Polish orthodontic taxonomy according to Orlik-Grzybowska differentiates malocclusions in relation to three spatial planes: sagittal, orbital and horizontal. Distal occlusions, generally called distocclusions are classified as belonging to anteroposterior defects examined in relation to the orbital plane. The characteristic common features of distal occlusions include increased overjet, retracted or everted lower lip, predominance of abductor over adductor muscles.

In English-language literature, a division of malocclusions into classes I, II and III on the basis of skeletal and Angle's classification is used. Angle's classification is based on the relationship of the first upper molars to the lower molars, assuming the unchanging position of the first upper molars in relation to the bone [11].

Angle Class II is diagnosed when the mesiobuccal cusp of the upper first molar is in the space between the second premolar and the first lower molar. Incomplete Angle Class II occurs, when the mesiobuccal cusp of the upper first molar covers the mesiobuccal cusp of the lower first molar.

The description of the relationship of anteroposterior dental arches in Angle's classification was further developed by Andrews' keys to normal occlusion [12].

The first key defines the position of first molars:

A – The distobuccal cusp of the permanent upper first molar makes contact with the mesial surface of the mesiobuccal cusp of the lower second molar.

B – The mesiobuccal cusp of the permanent upper first molar is in the buccal groove of the permanent lower first molar (Fig. 1).
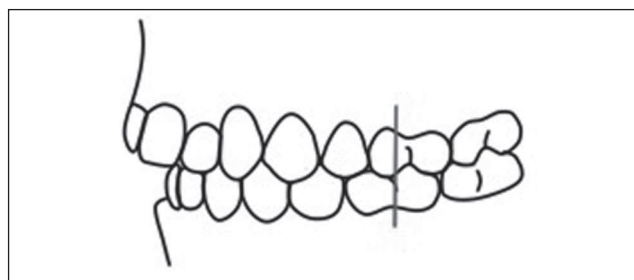

Fig. 1. The correct relationship of the first molars from the vestibular side on the basis of the first key to normal occlusion by Andrews.

Ryc. 1. Prawidłowa relacja pierwszych zębów trzonowych od strony przedsionkowej na podstawie pierwszego klucza prawidłowej okluzji według Andrewsa.
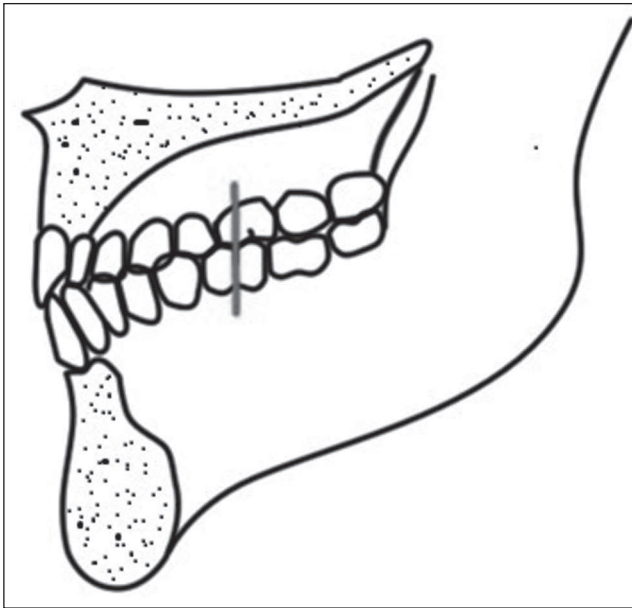
Fig. 2. The correct relationship of the first molars from the palatal side on the basis of the first key to normal occlusion by Andrews.

Ryc. 2. Prawidłowa relacja pierwszych zębów trzonowych od strony podniebiennej na podstawie pierwszego klucza prawidłowej okluzji według Andrewsa.

C – The mesiolingual cusp of the permanent upper first molar is in the central groove of the permanent first lower molar (Fig. 2). The determination of the skeletal class is also based on the analysis of a cephalometric picture [1]. Determining Class II malocclusions includes dental defects (posterior molar relationship – Angle Class II), as well as skeletal and functional mandibular defects. Full diagnostics of Class II has to include all the elements of a standard examination and case analysis: medical history, physical examination, analysing cast models and radiological documentation – above all, panoramic radiographs and cephalometric images.

THE AIM OF THE WORK

The aim of the work is to determine the significance of the posterior relationship of the first upper and lower molars from the palatal side in diagnosing Class II malocclusions.

MATERIALS AND METHODS

The research material consisted of diagnostic cast models and lateral cephalograms of patients at the Zbigniew Żak District Memorial Outpatient Clinic in Cracow from 2007 to 2013.

The criteria of including the material into the study were as follows:
1. bilateral Angle Class II on diagnostic models with the habitual bite registered by bite registration wax,
2. patients with mixed and permanent dentition, without tooth absences in the support zone in both dental arches.

Criteria of excluding the material from the study were as follows:
1. previously conducted orthodontic treatment,
2. crossbite within the permanent first molars,
3. deterioration of molar cusps and their excessive abrasion,
4. prosthetic additions.

One hundred and fifty cast models of patients' dentition were selected, comprising those of 89 female and 61 male patients. The youngest patient was 8 years and 5 months old, the oldest one 41 years and 7 months old, while the mean age was 17 years and 1 month. The number of patients with permanent dentition was 120 (80.0%) and with mixed dentition 30 (20.0%). Cephalometric pictures from the documentation of these patients were analysed as well. The diagnostic models were assessed

Fig. 3. A diagnostic cast model with auxiliary lines on the buccal surfaces of the permanent first upper and lower molars showing Angle Class II.

Ryc. 3. Model diagnostyczny gipsowy z liniami pomocniczymi na powierzchniach policzkowych stałych, pierwszych zębów trzonowych górnych i dolnych, przedstawiający II klasę Angle`a.
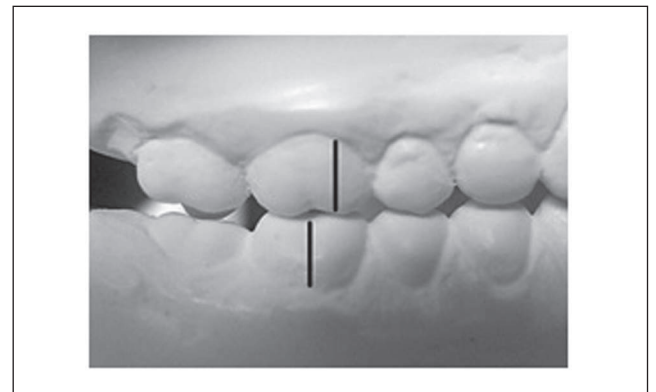

Fig. 4. A diagnostic cast model with auxiliary lines on the buccal surfaces of the permanent first upper and lower molars showing incomplete Angle Class II.

Ryc. 4. Model diagnostyczny gipsowy z liniami pomocniczymi na powierzchniach policzkowych stałych, pierwszych zębów trzonowych górnych i dolnych, II klasę guzkową Angle`a.
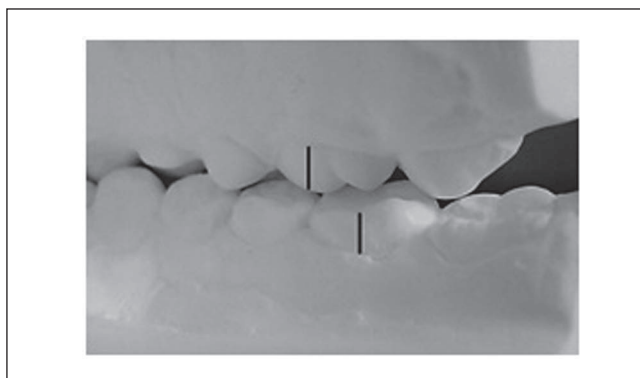
Fig. 5. A diagnostic cast model with auxiliary lines on the lingual and palatal surfaces of the first upper and lower molars showing the complete posterior relationship of the first molars.

Ryc. 5. Model diagnostyczny gipsowy z liniami pomocniczymi na powierzchniach językowych i podniebiennych pierwszych zębów trzonowych górnych i dolnych, przedstawiający pełną relację dotylną pierwszych zębów trzonowych.

Fig. 6. A diagnostic cast model with auxiliary lines on the lingual and palatal surfaces of the first upper and lower molars showing an incomplete posterior relationship of the first molars.

Ryc. 6. Model diagnostyczny gipsowy z liniami pomocniczymi na powierzchniach językowych i podniebiennych pierwszych zębów trzonowych górnych i dolnych, przedstawiający niepełną relację dotylną pierwszych zębów trzonowych.

Table I. Breakdown of marked relationship of permanent first molars from the palatal side.

Tabela I. Rozkład oznaczonych relacji pierwszych stałych zębów trzonowych od strony podniebiennej.

	Number	Percentage
Complete posterior relationship according to AK1C bilaterally *Pełna relacja dotylna według AK1C obustronnie*	71	47.3
Incomplete posterior relationship according to AK1C bilaterally *Niepełna relacja dotylna według AK1C obustronnie*	45	30.0
Correct relationship according to AK1C bilaterally *Prawidłowa relacja według AK1C obustronnie*	17	11.3
Right side complete posterior relationship according to AK1C Left side incomplete posterior relationship according to AK1C *Prawostronnie pełna relacja dotylna według AK1C* *Lewostronnie niepełna relacja dotylna według AK1C*	4	2.7
Right side incomplete posterior relationship according to AK1C Left side correct relationship according to AK1C *Prawostronnie niepełna relacja dotylna według AK1C* *Lewostronnie prawidłowa relacja według AK1C*	2	1.3
Right side complete posterior relationship according to AK1C Left side correct relationship according to AK1C *Prawostronnie pełna relacja dotylna według AK1C* *Lewostronnie prawidłowa relacja według AK1C*	1	0.7
Right side incomplete posterior relationship according to AK1C Left side complete posterior relationship according to AK1C *Prawostronnie niepełna relacja dotylna według AK1C* *Lewostronnie pełna relacja dotylna według AK1C*	8	5.3
Right side correct relationship according to AK1C Left side complete posterior relationship according to AK1C *Prawostronnie prawidłowa relacja według AK1C* *Lewostronnie pełna relacja dotylna według AK1C*	2	1.3

AK1C – Andrews' first key to normal occlusion, part C
AK1C – pierwszy klucz prawidłowej okluzji według Andrewsa podpunkt C

from the buccal side in order to determine Angle Class and from the palatal/lingual side in order to identify tooth relationship according to the first key to normal occlusion by Andrews. During the cephalometric analysis, the ANB angle was measured in accordance with Segner and Hasund's analysis and the Wits appraisal was performed according to Jacobson.

The ANB angle of 0-4°indicates skeletal Class I; the ANB angle of over 4°indicates skeletal Class II; the angle under 0° defines skeletal Class III [13].

According to Jacobson, skeletal Class I is diagnosed when the value of the Wits indicator is between 0 and 2 mm, skeletal Class II occurs when the value is over 2 mm and skeletal Class III when the value is under 0.

RESULTS

Angle class and the relationship of the first molars from the palatal side were determined on diagnostic cast models.

Table I presents the results of the analysis of diagnostic models from the vestibular and palatal sides. Skeletal relationships were assessed on cephalometric pictures.

Out of 150 lateral cephalometric pictures, 108 cases were diagnosed with the ANB angle of over 4° (skeletal Class II), which constituted 72%, and in 115 cases the Wits appraisal was ≥2 mm (skeletal Class II), which constituted 76.7%.

In 73 cases (48.7%) that were found to have bilateral complete Angle Class II, skeletal Class II was confirmed based on the ANB angle of over 4°.

In 21 cases (14%), skeletal Class II did not occur, despite the occurrence of bilateral complete Angle Class II. In 68 cases (45.3%) that were found to have a bilateral complete posterior relationship of permanent first molars from the palatal side, skeletal Class II was confirmed based on the ANB angle of over 4°. In 3 cases (2%) skeletal Class II did not occur despite the existence of a bilateral full posterior relationship of permanent first molars from the palatal side.

In 8 (5.3%) cases with bilateral complete Angle Class II and the correct relationship of permanent first molars according to AK1C, skeletal Class II was not confirmed based on the ANB angle.

In 75 cases (50%) who were diagnosed with complete Angle Class II, skeletal class II was confirmed based on the Wits appraisal of ≥2 mm. In 19 cases (12.7%) skeletal Class II did not occur, despite the existence of bilateral complete Angle Class II. In 69 cases (46%) who were diagnosed with a bilateral, complete posterior relationship of permanent first molars from the palatal side, skeletal Class II was confirmed based on the Wits appraisal of ≥2 mm. In 2 cases (1.3%), skeletal Class II did not occur despite the occurrence of a bilateral complete posterior relationship of permanent first molars from the palatal side. In 8 cases (5.3%) with complete Angle Class II and the correct relationship of permanent first molars according to AK1C, a skeletal class other than II was confirmed on the basis of the Wits appraisal.

DISCUSSION

Permanent first molar relationships are usually described with the help of Angle's classification. However, precisely determining the position of molars also requires analysing the position of these teeth from the palatal side.

This test, impossible to be conducted in the oral cavity of the patient, is done on diagnostic cast models with the help of a mouth mirror. The models can also be dissected along the midline, or a 3D scanner could be used to evaluate digital models in a computer program [14, 15]. The assessment of molar relationship from the buccal and palatal sides may be divergent, as showed e.g. by Liu and Melsen's study, where 21.6% of the 459 examined cast models showed a discrepancy in first molar relationships. When incomplete Angle Class II was diagnosed, 55% of the molars from the palatal side were in the correct relationship and 45% demonstrated an incomplete posterior relationship. In 63% of the cases with complete Angle class II, an incomplete posterior relationship of permanent first molars from the palatal side was found, and 17% of the cases showed a complete posterior relationship [16]. While assessing the relationship of permanent first molars both from the buccal and the palatal sides, Jang et al. showed that when incomplete Angle Class II occurred, in 86.7% of cases, the correct relationship of the first molars from the palatal side was diagnosed, whereas when a complete Angle Class II was present, in 65.3% of the cases an incomplete posterior relationship was marked and in 34.7% of the cases a complete posterior relationship of permanent first molars from the palatal side was found [17].

In our study, in 66 of the 150 cases examined (44%), the relationships of the first molars from the vestibular side did not correlate with the position of the molars from the palatal side. This discrepancy may be due to the rotation of the permanent first molar of the maxilla. In mixed dentition, the rotation of permanent first molars occurs in 84% of the cases [18]. Braun showed that rotations of permanent upper first molars occur in 85% of all occlusion relations, in 90% of all the Class II cases of Subdivision I and in 100% of narrow jaw cases [19]. In the study presented, there were 8 cases with complete Angle Class II and the correct relationship of the first molars from the palatal side, and none of them was found to have skeletal Class II, which proves a dental reason for the formation of Angle Class II. In the case of the occurrence (with the coexisting Angle Class II) of the correct relationship of permanent first molars from the palatal side, the procedure usually involves the derotation of the upper molar to match Angle Class I.

Moreover, in our study, with a diagnosed bilateral complete Angle Class II, 78% of the patients had their skeletal Class II confirmed based on measuring the ANB angle and 80% based on the Wits appraisal.

Analysing first molar relationships from the palatal side in order to diagnose skeletal Class II also makes it possible to reliably identify people without the occurring skeletal Class II. Not determining a complete, bilateral posterior relationship of permanent first molars from the palatal side suggests that skeletal Class II will not be diagnosed either based on the ANB angle or the Wits appraisal.

CONCLUSIONS

The diagnostic stage is a key element of orthodontic treatment. Diagnosing a bilateral complete posterior relationship of permanent first molars from the palatal side constitutes a very reliable predictive parameter of skeletal Class II. In turn, the correct relationship of the first molars from the palatal side leads to a high probability that skeletal Class II does not occur.

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